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Lessons Learned in a School of Hard Knocks

Secondary Payloads
and
Co-manifested NASA missions

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Reality of being a Secondary

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Secondary Spacecraft will say anything to get a “free ride” with a mission that has excess capability (based on my personal experience)

- What has been said:

- I can live with any orbit; the PrimeSat mission is a perfect match for me
- I will be ready for any launch date

- My interface is the same as XYZsat
- I only have an antenna or two that sticks below the separation plane

- What was really meant:

- As long as its between 700 and 800km with a nodal crossing time of...
- But I only have 5 people working on my project, have no slack, and if Im delayed for a year everybody will have moved on

- With the exception of.....
- (See picture)

Spalding Smails: “I want a hamburger... no, a cheeseburger. I want a hot dog. I want a milkshake...”

Judge Smails: “You'll get nothing, and like it”

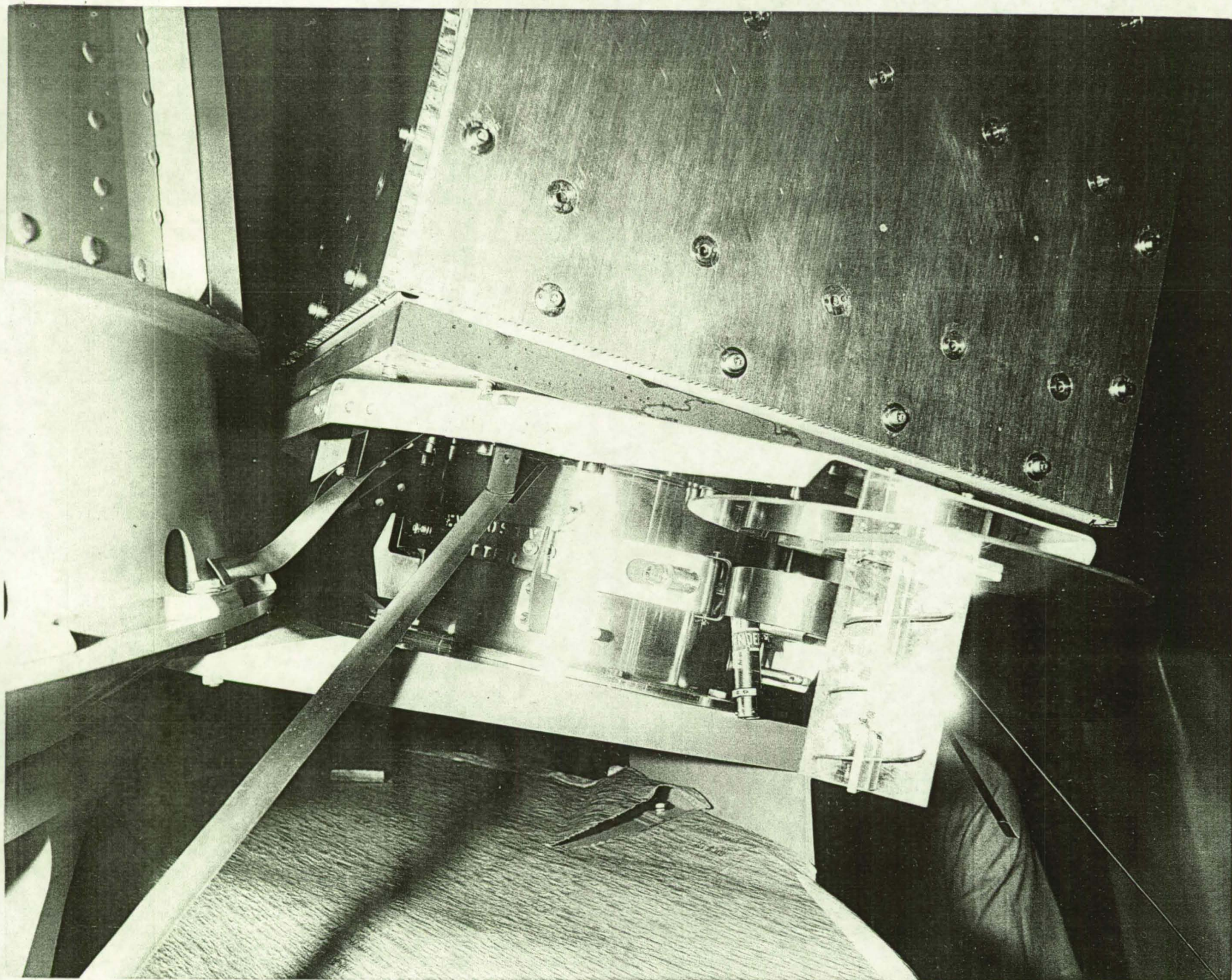
Courtesy of the movie Caddieshack

Picture of Sep Plane

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Note: photo is of the UOSAT ("OSCAR") ~~SPACE~~
SPACECRAFT MOCK-UP FROM THE 1980's. SPACECRAFT
WAS BUILT BY UNIVERSITY OF SURREY IN ENGLAND

photo by Mc Donnell Douglas Corp



Reality of being a Secondary

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- As we all know, there is no such thing as a free ride; integration cost is not free. However, Secondary payloads don't pay for their portion of the basic lift capability
 - As a result, the Primary Spacecraft will go when they are ready
 - The Primary Spacecraft has the right to know the Secondary will not impact them!
- Even integration costs are high compared to what Secondary payloads want to pay for launch
- The job of the Launch Provider (LSP and Launch Service Contractor) is to ensure the Primary mission is successful, and that the Secondary poses no or minimal risk to the Primary mission
 - Success of the Secondary mission, is just that, secondary
 - Therefore, to get a ride you must think of the Primary as much, or MORE than you think of your own needs
 - Once the risk to the Primary has been minimized, then your requirements will be accommodated as much as possible
 - Desires will be considered, but manage your expectations

Reality of being a Secondary

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- The best Secondary is one with a “SIMPLE STANDARD INTERFACE”
 - CubeSat/PPod example is a good example
- Communicate what you require, and what you desire BEFORE accepting a “free ride”; know the difference
- In many cases you need to plan for a mass simulator in the event you don’t make it (quote below from LSP Engineering Review Board)
 - “ICESAT will fly without CHIPSAT if CHIPSAT is not in a position to fly. Critical to understand how late a no-fly decision for CHIPSAT can be rendered without impact to ICESAT launch date”
- You need to have plans in place for sustaining your program for 6 months to a year beyond the planned launch date
- You need to have good documentation to prove you meet the requirements established to reduced risk for the Primary mission
- TEST LIKE YOU FLY (see pictures), it pays benefits everybody

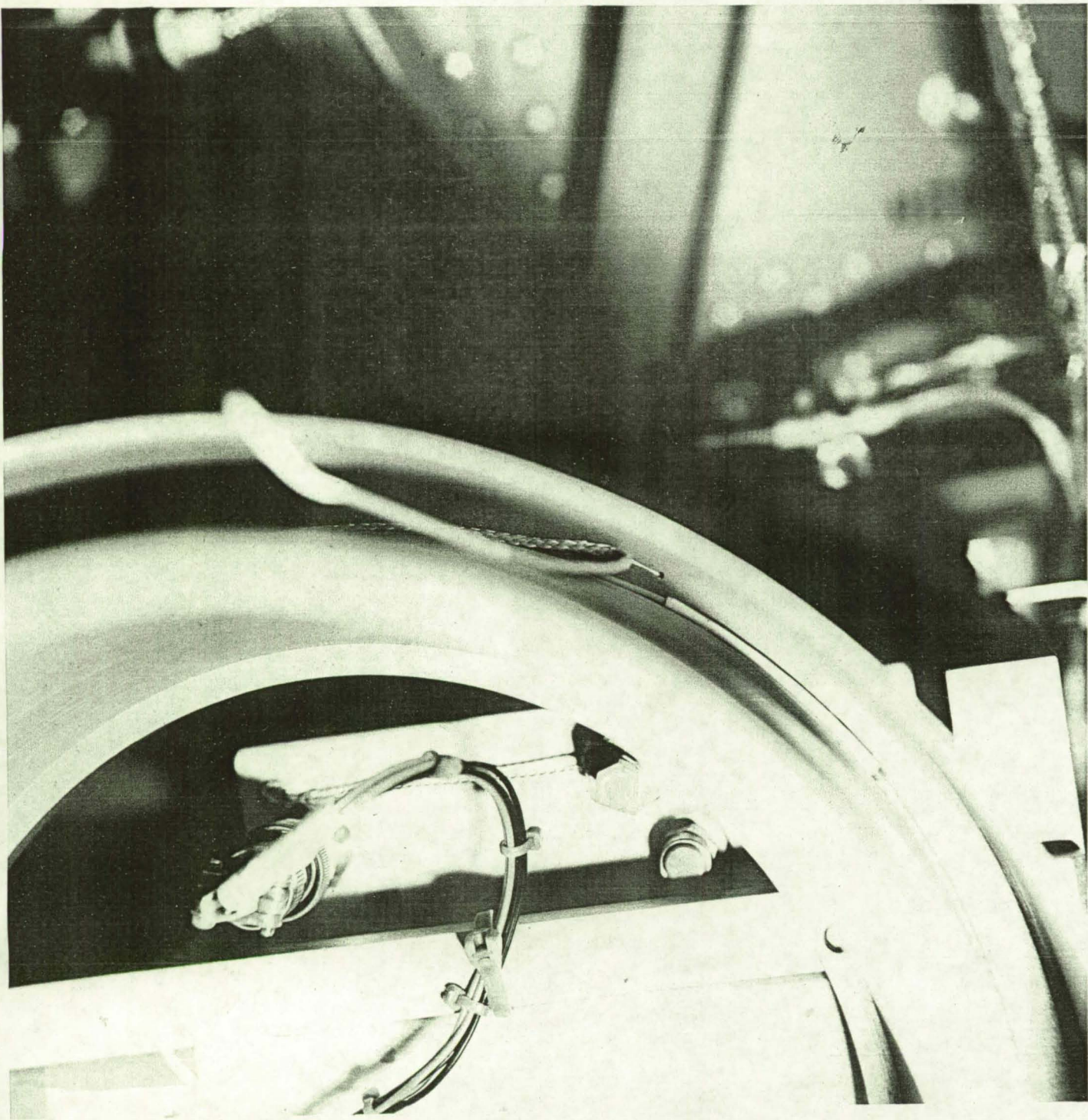
2 Pictures of Tether Mission

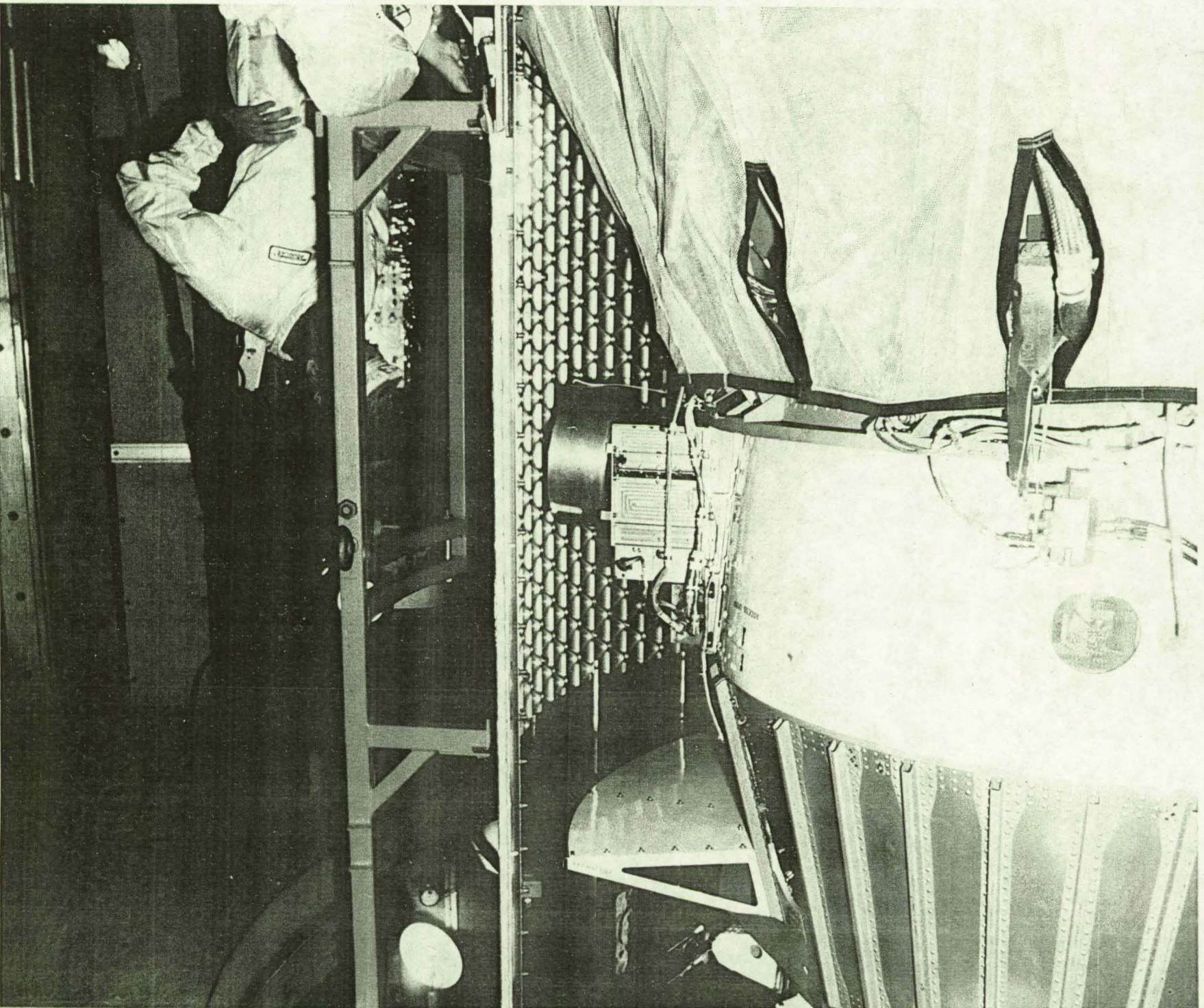
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~~1st~~ 1st Picture was taken by NASA KSC in 1993

2nd Picture was taken by NASA JSC in 1993, Similar to spacecraft photos typically seen in Space News

IF I CANT USE THEM, THEN ILL JUST DELETE THEM





So the good news is you have the money to buy $\frac{1}{2}$ a launch

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- Unlike a Secondary mission, the rocket won't launch without you, but..... It won't launch without your partner either
- Now you have to worry about two missions getting thru confirmation reviews, development, qualification testing without delay or cancellation
- Unlike a Secondary mission, your requirements must be met before launch, but...what is the impact of your partner's requirements on yours?

If I only knew then....

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A new Project Manager asked his mentor, “Jim, how much did your project save by co manifesting with that other payload”

The mentor replied “I don’t know yet because the government hasn’t received the delay claim from the launch provider or the spacecraft contractor yet”

- Fact: most government spacecraft do not launch on their originally scheduled launch date
- Fact: a co manifested spacecraft has a very high probability of being delayed by its own development issues AND the development issues of its partner
- Not all Project Managers are around long enough to make the deal to co- manifest the spacecraft and to pay the bills for delays?
- Recommendation: Take some of your savings assumed for a co-manifested mission and program them for launch delays

DON'T LET THIS HAPPEN TO YOU!

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Scenario

Engineering Review Board of the Interface ICD held less than 1 year before planned launch date

- ERB Recommendation:
 - The mission specification for this mission shall not be signed off by NASA until the mission specification requirements are clear and representative of the actual requirements.
- ERB Rationale
 - As written the mission specifications do not represent the current requirements , and are insufficient to document the interface, and insure compatibility between the two spacecraft; particularly in the area of thermal and flight design.
 - The presented state of the orbit and thermal requirements leave the board **believing there is a high probability of an incompatibility between the two spacecraft.** The final trajectory seems to be dependent on the clarification of the spacecraft conflicting thermal requirements. The spacecraft want to change there separation times which would aggravate the thermal incompatibility.

Things to think about before signing up for a co manifested mission

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- Launch date and schedule margin; yours and your partner's
- Risk tolerance of your Project and Stakeholders, and that of your partner; will it be the same at Project inception and launch day?
- Specific orbit characteristics, not just altitude and inclination
- Contamination requirements; what you can tolerate and what you produce
- Thermal and sun angle constraints
- Who's on top, and who's in the "can" (access requirements)
- It may seem silly, but which mission gets "first billing"